



California Morbidity

Review of Plague in California, 1997

Plague was detected in 18 of 35 California counties surveyed through the California Department of Health Services' (CDHS) cooperative plague surveillance program (Figure 1). Two human cases were confirmed: one in Kern County and one in Modoc County. Plague positive animals tested through the program included 31 coyotes, 7 black bears, 2 bobcats, 2 spotted skunks, 15 California ground squirrels, 2 golden-mantled ground squirrels, 4 Merriam's chipmunks, 4 deer mice, and one each mountain lion, raccoon, grey fox, feral pig, Belding's ground squirrel, shadow chipmunk, bushy-tailed woodrat, brush mouse, and meadow mouse.

Human Plague

Case #1. Plague was reported in June in a 71-year-old female resident of Bear Valley, Tehachapi, Kern County, who first presented to a Tehachapi district hospital on June 4 with a one-day history of abdominal pain and fever. She was prescribed antibiotics and released. The woman's condition did not improve and she presented again on June 6 with fever, abdominal pain, vomiting, diarrhea, and hallucinations. The patient had a moderate leukocytosis (30,000) with marked left-shift (30% bands). Blood was submitted for culture. Due to her acute abdominal condition and possible need for surgery, the patient was transferred to a Bakersfield hospital. Following transfer, additional blood culture specimens were obtained and the patient was placed on intravenous cephalosporin and metronidazole. An exploratory laparotomy was performed on June 8 and a large retroperitoneal mass was identified. Further exploration revealed it to be bilateral periaortic adenopathy. Several large nodes in the left peritoneum were removed and revealed acute, necrotizing, lymphadenitis with abscess formation. No bacteria were observed. On June 10, gram-negative rods were cultured from blood obtained at admission, and *Yersinia pestis* was suspected. The isolate was confirmed as *Y. pestis* by phage-typing performed at the CDHS' Microbial Diseases Laboratory.

The patient was placed in respiratory isolation and continued treatment with intravenous gentamicin and doxycycline. Thoracic radiographs obtained June 12 revealed minimal bilateral basilar infiltrates, but the patient developed no respiratory symptoms. Her abdominal pain resolved and her white blood cell count normalized over the 10-day course of antibiotic therapy. She was discharged on June 17 and instructed to continue oral doxycycline for an additional seven days. At follow-up one month after discharge, the patient was doing well. Despite the absence of respiratory symptoms, the hospital elected to initiate antibiotic prophylaxis for close contacts, including members of the surgical team and the microbiology staff.

On June 16, staff of the Kern County Environmental Health Department and the CDHS' Vector-Borne Disease Section (VBDS) conducted an environmental assessment of the patient's residence and environs. The residence is a newer wooden structure built to take advantage of nearby trees and rocks on a steep slope. Woodrat huts, squirrel burrows, and woodpiles with signs of rodent infestation were observed in close proximity to the home, with squirrel burrows extending under the foundation. Even though rodent signs were evident, only one live ground squirrel was observed on the property. Local residents confirmed a recent (past few weeks) disappearance of ground squirrels in the immediate vicinity. Several hundred ground squirrel fleas were collected from rodent burrows on the property, and four rodent carcasses were found in the vicinity. Serum samples from two live-trapped chipmunks, one rabbit, and two pet cats in the vicinity tested negative. Six flea pools forwarded to CDHS' Microbial Diseases Laboratory for testing were negative, as were all rodent carcasses. Fleas recovered from live-trapped rodents and flagged from rodent burrows demonstrated straggling (species crossover), a recognized phenomenon observed during plague epizootic die-offs.

Despite the absence of confirmatory findings for *Y. pestis* from rodents or ectoparasites on the patient's property, the recent rodent disappearance and abundance of remaining ground squirrel fleas in burrows suggest that the patient was most likely exposed in or around her home. The patient took daily walks in the vicinity of her home and reported experiencing flea bites, including on her left thigh approximately one week prior to onset. She denied direct contact with live or dead animals, other than her friend's pet dog which accompanied her on walks in the neighborhood. The patient's home and surrounding property were treated to control fleas and recommendations were made for professional rodent proofing. In addition, recommendations were made to conduct flea control at nearby recreational sites.

Without her surgery, this case might have been classified as septicemic plague when, in fact, she had bubonic plague (with secondary bacteremia); her buboes were inapparent retroperitoneal (bilateral periaortic) nodes that were identified only at surgery.

Case #2. The second case of plague occurred in August in a 58-year-old male resident of Alturas, Modoc County. The patient had onset of fever (104°F) and left axillary lymphadenitis on approximately August 5, 1997. He consulted a physician in Alturas who noted leukocytosis (31,000) and mild hypotension. No further diagnostic workup was conducted at that time and the patient was treated with intravenous ceftriaxone and tetracycline. The patient recovered soon thereafter but, dissatisfied with an unspecified diagnosis, he consulted another physician on August 26. Serum specimens were obtained and submitted to the Shasta County Public Health Laboratory. The specimen was sent to CDHS' Microbial Diseases Laboratory and forwarded on to the Bacterial Zoonosis Branch, CDC, for suspect plague testing. CDC reported a titer of 1:256 to *Y. pestis* by passive hemagglutination (PHA) and positive IgM detection against F1 antigen of *Y. pestis*. No blood or lymph node aspirate was available for microbiologic evaluation. Convalescent serum specimens obtained from the patient in mid-October demonstrated a 4-fold increase in IgM titer to 1:1024 and a weakly positive IgG reaction by PHA.

The patient is a veterinarian with a large animal practice in Alturas. In the week preceding his illness, he administered *Brucella* vaccination to cattle herds throughout Modoc County. Also during that time, he made two trips to Modoc National Forest lands: on August 1 to cut firewood near the intersection of the east shore road of Goose Lake and the road to Crowder Flat (25 miles north of Alturas); and, on August 5, to observe wildflowers near Cottonwood Flat campground (10 miles west of Canby). During the second trip he stopped at a private ranch 7 miles west of Canby, where he was informed of a sick pet cat. The patient examined this cat the next day at his office in Alturas. The cat was described as dehydrated and moribund with a submandibular abscess, but was afebrile. The cat scratched the patient while he was treating it. Later, the cat reportedly died at the ranch and was disposed of. The carcass was unavailable for further testing.

Biologists from VBDS, accompanied by Modoc County Health Department staff, investigated all three locations visited by the patient during the week prior to his illness. The campground was ruled out as a possible exposure site since rodent activity at this location was minimal and there had been no recent rodent die-off. With permission of the owner, the ranch west of Canby was surveyed for rodent activity and trapped for rodents. An interview with the ranch owner revealed that another cat had died several weeks prior being treated by the veterinarian. The owner related that cats on the ranch routinely brought in captured mice and woodrats, but 7 woodrats and 9 deer mice trapped on the ranch tested serologically negative for plague antibody by PHA test. Ground squirrel activity on the ranch appeared light; however, inclement weather prevented an accurate environmental interpretation.

The investigation in this case is continuing. Three wild carnivores from Modoc County were serologically positive in 1997; one was near the city of Alturas, demonstrating plague activity among rodent prey populations within the county. The exact source of exposure in the case remains unknown but it was probably his exposure to an infected domestic cat that was responsible.

Animal Plague

Plague surveillance by VBDS at Lava Beds National Monument, Siskiyou County, revealed a partial disappearance of woodrats in lava caves frequented by park visitors near the park headquarters. One woodrat sampled from the caves tested serologically positive for plague antibody. Park rangers were alerted and plague warnings were posted at park headquarters, picnic grounds, and campgrounds. No additional evidence of plague was obtained following this early surveillance in March. A coyote from Butte Valley, west of Lava Beds National Monument, was later reported serologically positive.

Six of 10 coyotes sampled in March by USDA, Wildlife Services, from properties north of Loyalton in Sierra Valley, near the Plumas-Sierra County line, and 3 of 8 from near Beckworth in Plumas County demonstrated high antibody titers to *Y. pestis* by PHA test. County health departments and U.S. Forest Service district offices in these counties were alerted to these results. In October, 4 of 10 additional coyotes from the Loyalton area were reported as positive. No reports of die-offs among susceptible rodent populations, such as ground squirrels, have been reported from the area.

In El Dorado and Tuolumne Counties, two seropositive coyotes were reported at elevations below 2000 ft. on the western slope of the Sierra Nevada mountains. In Yosemite Valley, Mariposa County, two black bears were reported positive through the cooperative surveillance effort with the Yosemite National Park Resources Division.

In the vicinity of north Lake Tahoe, a moribund chipmunk from a private residence at Alpine Meadows, Placer County, tested bacteriologically positive for *Y. pestis*. The Placer County Environmental Health Department alerted local residences through a media release in the area. On investigation by VBDS, no further evidence of plague was found. Five additional suspect rodents from the immediate area tested negative.

On the eastern slope of the Sierra Nevada, surveillance at recreation sites in Mono County detected a seropositive Belding ground squirrel at an Inyo National Forest campground near June Lake. The area was posted with plague warnings and U.S. Forest Service personnel and campground concessionaires were alerted to watch for indications of rodent die-off and to submit suspect animals for testing. No additional positive samples were obtained from this region.

In the coastal region, a coyote from Blue Rock, Mendocino County, showed serological evidence of plague in early summer. A feral pig and a grey fox demonstrated plague antibody on PHA test from the coast ranges of Santa Clara County. Further south on the coast, a seropositive mountain lion was reported from near Paso Robles, San Luis Obispo County.

In Kern County, a seropositive coyote was reported west of the Tehachapi area in February and another in May, preceding the human case at Tehachapi. More extensive evidence of animal plague was found from mid-April to the end of May near Frazier Park. Nine of 19 coyotes and 1 bobcat from the western end of the Tehachapi mountains demonstrated antibody titers to *Y. pestis*. Plague surveillance in July by VBDS and Ventura County Environmental Health Department revealed extensive evidence of a plague epizootic at a Los Padres National Forest campground near Frazier Park. At this site, positive antibody titers to *Y. pestis* were reported in five species of rodents, and *Y. pestis* was isolated from a pool of fleas recovered from a meadow mouse.

In Los Angeles County, three black bears from the Angeles National Forest were reported to be serologically positive. In San Diego County, the San Diego County Vector Control District reported five serologically positive ground squirrels from two recreational campgrounds in the mountainous region of the interior portion of the county. The sites were posted with plague warnings, and emergency plague suppression measures were implemented by the control district at the two locations.

Plague positive fleas from a California ground squirrel were reported in July from a private camp in the San Bernardino mountains during surveillance by the San Bernardino County Vector Control Program. During August and September, surveillance in this area detected antibody positives in golden-mantled and California ground squirrels at recreational sites within the San Bernardino National Forest. Emergency plague suppression measures were implemented at all sites, using Diazinon 2D insecticide dust applied for flea control through burrow dusting and in bait stations.

In Riverside County, plague positive antibody titers were demonstrated among California ground squirrels at four separate recreational campgrounds in the San Jacinto mountains. Three of the sites are facilities operated by the San Bernardino National Forest, and the fourth is Riverside County Park. All sites were posted with plague warnings and recreation staff alerted. No additional evidence of plague activity was found. At one campground in this area, a three-year study of plague among individually marked ground squirrels has been ongoing by VBDS Ontario office staff. Twenty-seven ground squirrels demonstrated plague antibody to *Y. pestis* at the beginning of this study in 1995. Seven additional new squirrels demonstrated positives in 1996 and four more in 1997. Twelve of the marked animals at the site have been serologically sampled over the three year study. Important information has been obtained in this study on the immunological response to *Y. pestis* infection in individual ground squirrels in this mountain population.

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Laboratory testing for plague was done by CDHS' Microbial Diseases Laboratory; the Centers for Disease Control & Prevention, Ft. Collins, Colorado; Dr. Bruno Chomel, University of California, Davis; and the Los Angeles County Public Health Laboratory.

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PROGRAM ANNOUNCEMENT

Title: Basic Infection Control Program
Date: October 11-16, 1998
Sponsor: California APIC Coordinating Council
Place: Asilomar Conference Center – Pacific Grove, CA
Contact: Harriett Pitt, R.N. (562) 933-0389 or Shirley Chude-Sokel, R.N. (310) 478-3711, ext. 40280

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